Taxation and Capital Spending

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I. Introduction

Why should macroeconomists care about the taxation of capital income? From a longer-term perspective, capital income taxation affects the rate of capital accumulation and hence the rate of economic growth. Current discussions of fundamental tax reform focus especially on capital income taxation because of this connection to growth and because the current system of capital income taxation is so complex, leading to misallocation and hence effective reductions in productive capacity.

From a shorter-term perspective, the taxation of capital income matters because capital investment is the most volatile component of private spending. As a consequence, investment has been the object of frequent tax policy initiatives, the most recent being the temporary "bonus depreciation" provisions afforded qualifying capital investment by legislation passed in 2002 and 2003. But the same attribute that makes investment volatile – its strong dependence on expectations – also erects an obstacle to effective policy intervention, making the timing and strength of responses to tax policy difficult to predict. It is no accident that some of the most celebrated papers on the difficulty of accounting for expectations when implementing government policy have used investment incentives to demonstrate their points (e.g., Lucas 1976, Kydland and Prescott 1977).

This paper reviews the theory and evidence regarding the effects of taxation on investment. It also considers the simultaneous influence of taxation on asset values, of additional interest from a macroeconomic perspective because of the potential impact on the level of consumption and the health of the financial sector. I limit my focus to business fixed investment, and concentrate on the tax treatment of traditional C corporations; the tax rules facing other entities, such as limited liability companies and S corporations, differ in offering pass-through

treatment to owners, an important consideration when evaluating changes such as the 2003 reductions in tax rates on dividends and capital gains.

II. Taxation and the User Cost of Capital

The classic vehicle for analyzing the impact of taxation on investment is Jorgenson's (1963) *user cost of capital*, an expression that incorporates prices, tax provisions, financing costs and depreciation. According to this formulation, each unit of capital needs to earn a gross return (before taxes and depreciation) equal to

$$(1) \qquad \frac{q(1-\tau z)(r-\pi+\delta)}{(1-\tau)}$$

in order to break even. In expression (1), q is the unit price of capital goods, π is the corresponding capital goods inflation rate, τ is the corporate tax rate, z is the present value of depreciation deductions per dollar of new capital, r is the firm's nominal cost of funds (presumably a weighted average of debt and equity costs[1]), and δ is the rate at which capital depreciates.

Without taxes, the required rate of return, $r-\pi+\delta$, would cover financial costs plus depreciation. Note that the inflation rate relevant for calculating the real rate of return is based on the price of capital goods, because the decision to hold an extra unit of capital during the current period can be viewed as a decision to buy the capital now rather than one period hence. A higher capital goods inflation rate makes waiting to invest less attractive, i.e., encourages immediate investment, while falling capital goods prices promote delay.

[1] The cost of debt, in this formulation, is the after-tax interest rate, i.e., would reflect the reduced cost to the firm resulting from the deduction of interest. No such tax adjustment is applied to the cost of equity capital because there is no deduction for equity costs.

With taxes, the effective, out-of-pocket price of capital goods is reduced to $q(1-\tau z)$ and the required return is therefore reduced proportionately.[2] But because the firm faces a tax rate τ, a before-tax return of $1/(1-\tau)$ dollars is needed to deliver a one-dollar after-tax return. A customary means of summarizing the impact of taxation through the terms τ and z is the effective tax rate – the tax rate that, if imposed on the company's income net of true economic depreciation, would result in the same user cost of capital. If true economic depreciation were actually provided, then the effective tax rate would just equal the statutory tax rate, τ. On the other hand, if investment expenses could be written off immediately, the present value of depreciation deductions, z, would equal 1 and the effective tax rate would equal zero – the immediate write-off of investment effectively offsets the subsequent taxation of returns.[3]

A. Dynamics and Expectations

The user cost expression in (1) provides a measure of the tax system's long-term impact on the demand for capital, but it requires two modifications to be used in the analysis of investment dynamics.

First, it is necessary to account for expected changes in the tax system, for these will influence the incentive to invest. Expected changes in tax provisions exert their impact through the capital goods inflation rate, π. When tax provisions change over time, it is the inflation rate of the effective capital goods price, $q(1-\tau z)$, that matters. Just as faster expected growth in the capital goods price, q, is a spur to current investment, so is expected growth in the out-of-pocket share of this price, $(1-\tau z)$. Thus, an expected reduction in the generosity of depreciation

[2] Prior to 1986, the investment tax credit further reduced the effective price of qualifying capital goods.

[3] Taking interest deductions into account, the effective corporate tax rate with immediate expensing would be negative.

provisions encourages investment now (to lock in the existing depreciation schedule); so would an expected reduction in the corporate tax rate at which depreciation deductions may be taken, although corporate tax rate changes will also have other effects on investment, discussed below.

Second, investment decisions cannot be implemented instantaneously. As a result of production and delivery lags and costs of adjustment, changes in the user cost of capital and hence in the incentive to invest translate into actual investment only gradually. Further, because firms know that the investment process takes time, they will care not only about the incentive to use capital today – the current value of the user cost – but also on the incentives to use capital in the future. Indeed, under an adjustment technology consistent with Tobin's *Q* theory of investment[4], the investment process is described by a partial adjustment model, in which investment responds gradually to the gap between the actual and desired capital stocks, and the desired capital stock is dictated by a weighted average of current and expected future user costs of capital; the slower the adjustment process, the more weight is attached to future user costs, because the more impact current decisions will have on future capital use (Auerbach 1989). Only if tax parameters and other elements of the user cost of capital are expected to remain constant over time will the desired capital stock depend solely on the current user cost.

With this forward-looking model, one can predict the effects of tax policy on investment. These effects differ with respect to tax policy's form (tax rate versus depreciation deductions), timing (immediate versus deferred), and duration (permanent versus temporary). Among the conclusions that result from this analysis are that (1) a reduction in the corporate tax rate encourages investment; phasing in such a reduction may encourage investment even more, by

[4] With respect to tax policy applications, see, particularly, Summers (1981) and Abel (1982). The parameter *Q* is capitalized here to distinguish it from the market capital goods price, *q*. Tobin's *Q* is the full cost to the firm of putting an extra unit of capital in place, including not only the direct cost *q* but also the internal adjustment costs incurred through installation, production disruptions, etc.

giving investors an opportunity to take depreciation deductions at a higher rate before being taxed at a lower rate on investment returns; and (2) temporary investment incentives are likely to have a more powerful impact on investment than permanent incentives, by encouraging firms not only to invest more but also to shift investment forward. Note, though, that these conclusions relate to the *expected* path of tax policy, not necessarily to what is legislated or promised.

As an example, consider the recent bonus-depreciation episode. As introduced originally in 2002, bonus depreciation provided an immediate 30-percent write-off for qualifying investment and an expiration date of September, 2004. Investment in 2002 should have been stronger if this legislated expiration were credible than if it were not; investment might have been weaker had investors correctly anticipated the further *increase* in bonus deprecation (to 50 percent) that occurred in 2003, given the resulting incentive to delay. What were expected future user costs in 2002? Indeed, what were expected future user costs *before* 2002? Given the steep drop in equipment investment after 2000, the further drop in investment of 2001 and the recession of 2001, an investment-oriented tax initiative could not have been totally unexpected. Based on a model of the determinants of historical policy changes[5], Auerbach (2003) estimated the probability of an increase in investment incentives in 2002 to have been close to 1 and the probability of a further increase in 2003 to be greater than 0.5. Thus, the 2002 and 2003 changes were somewhat predictable and should have had a negative impact on investment prior to 2002.

B. Investment and Market Value

As the *Q* theory illustrates, adjustment lags and changes in market value go hand in hand. As firms encounter short-run constraints in reaching their desired capital stocks, a premium

[5] The ordered probit model, based on annual data through 2002, related the probability of a large increase or decrease in the tax component of the user cost of capital, from expression (1), to lagged changes in investment, the lagged federal budget deficit and lagged GDP gap.

attaches to capital already in place. The slower the adjustment, the greater the fluctuations in value one would expect. At one extreme, with rapid adjustment, increases in tax incentives will have little impact on the value of capital in place, because greater after-tax profitability will be eliminated almost immediately by additional investment. At the other extreme, with very slow adjustment, changes in the user cost of capital will largely be capitalized into the value of capital already in place. The size and nature of adjustment costs are somewhat unclear. Even if costs internal to the firm are insignificant, there is evidence that firms face external short-run supply constraints for capital goods that have the same impact (Goolsbee 1998). A related issue is whether responses weaken when there is excess capacity, a relevant consideration in recent years for some industries although one study casts doubt on its importance (Desai and Goolsbee 2004).

Whatever the process of adjustment, there will be a negative relationship between the direct investment stimulus of a change in the user cost and the indirect demand stimulus associated with an increase in asset values. But there is an additional channel through which tax policy affects asset values – the relative tax treatment of capital assets of different vintages.

Depreciation allowances are more generous for new capital than for existing capital because of accelerated depreciation (which causes benefits to be front-loaded and hence no longer available to older vintages of assets) and the required use of historic cost to determine depreciation deductions. Thus, assets in place should be valued at a discount relative to new capital. This discount can rise or fall with changes in tax policy. An increase in depreciation deductions, as provided through bonus depreciation, should increase the discount. A reduction in the corporate tax rate, on the other hand, should decrease the discount.

The variation over time in the existing-capital discount implied by tax policy has been significant. Calculations in Auerbach (1983) found a discount of around 20 percent for corporate

fixed capital just after the Economic Recovery Act of 1981, due to the combination of high inflation, accelerated depreciation, and the investment tax credit. The Tax Reform Act of 1986 reduced this discount substantially by lowering the corporate tax rate and eliminating the investment tax credit, with the drop in inflation over the same period working in the same direction. Auerbach (1996) estimated a discount for the mid-1990s of less than 10 percent.[6]

While increases in the value of depreciation deductions and cuts in the corporate tax rate both should increase the value of newly installed capital, the overall impact on asset values should depend as well on the existing-capital discount. For the tax cut, the two effects work in the same direction, and asset values should rise. For the increase in depreciation deductions, the two effects are opposed and the direction of impact on asset values ambiguous. As a consequence, polices that are good for investment are not necessarily good for asset values, and policies that help asset values don't necessarily spur investment. An illustration of the latter possibility is the Tax Reform Act of 1986, which, according to theory, should have slightly discouraged corporate investment while still increasing corporate asset values, the small decline in the value of newly-installed capital being swamped by the large reduction in the existing-capital discount (Auerbach 1989).

C. Shareholder Taxes

The firm's cost of capital and hence its incentive to invest depends on its required returns to investors. Leaving aside the complex issue of how taxes affect optimal capital structure, we can ask how taxes affect the required rates of return to debt and equity. For debt, the key question is how to factor in the range of tax rates bondholders face. With a substantial share of

[6] This same trend has been noted recently by McGrattan and Prescott (2005) in an analysis of stock price movements over the past few decades.

debt held by tax-exempt domestic investors or foreign investors, there may be little or no impact of U.S. taxes on recipients of corporate interest.

Determining the effect of taxes on the required return to equity is considerably more complicated. First, it is customary to assume that a risk premium applies to holding equity; among the many factors that should affect this risk premium is the tax system. Since the work of Domar and Musgrave (1944), it has been understood that the tax system plays a risk-sharing role. The higher the corporate tax rate, the more insurance is provided, and hence the lower the required risk premium should be. Thus, it is not appropriate to take the required return to equity as given when considering the effects on investment of changes in corporate tax provisions. This is particularly relevant when comparing the effects of corporate tax rate reductions, which reduce the degree of insurance, and changes in investment incentives such as accelerated depreciation and investment tax credits, which have no comparable insurance effect. This issue has received relatively little attention in the empirical investment literature, perhaps because measuring the equity cost of capital is so difficult to begin with.

A second problem in determining the effects of taxes on the equity cost of capital is that the impact of individual income taxes is unclear. Whereas the taxation of interest income is relatively simple – accrued interest is taxed annually, even (through the rules that apply to original issue discount obligations) if interest is not paid annually – the taxation of dividends and capital gains is not. Capital gains are taxed only on realization, and dividend taxes are payable only to the extent that corporations choose to distribute dividends, rather than repurchasing shares or retaining earnings.

A traditional approach has been to assume that shareholder returns are taxed at a blended rate, with distributions hit by the dividend tax rate and retained earnings subject to a capital gains

rate adjusted downward to reflect the advantages of tax deferral. But, for mature firms whose equity capital comes primarily through retained earnings, this approach is logically flawed, for it ignores the initial tax benefit of retaining earnings – the avoidance of current taxes on dividends. An alternative theory, frequently referred to as the "new" or "trapped equity" view of corporate dividend taxation (e.g., Auerbach 1981), holds that this initial tax benefit offsets any future impact of dividend taxes, so that the effective tax rate at the shareholder level is a very low effective capital gains tax rate, regardless of dividend policy.[7]

Through the years, different empirical strategies have been used to test the relative validity of the traditional and new views of the impact of equity taxation. One approach, based on the *Q*-theory investment model, appeared to provide strong support for the traditional view when based on U.K. data (Poterba and Summers 1983) but equally strong support for the new view when based on U.S. data (Desai and Goolsbee 2004). Other approaches focusing on rates of return (Auerbach 1984) and the source of investment funds (Auerbach and Hassett 2003) have suggested the presence of firm heterogeneity, with the new view more relevant for "mature" firms with ample internal funds.

Although aspects of the issue are unresolved, the new view remains a serious enough alternative that its implications regarding the effects of tax policy require attention. One important implication is that, for firms obtaining equity funds through retained earnings, a permanent change in the tax rate on dividends should have no impact on the user cost of capital, acting simply on corporate asset values – an increase in the value of existing capital relative to

[7] The original discussion of the new view assumed that all distributions took the form of dividends, but the analysis can be extended to the case in which firms also repurchase shares. The key assumption remains that firms reduce distributions to invest and thereby reduce shareholder taxes, although the tax rate on distributions now depends on the mix between dividends and repurchases. See Auerbach and Hassett (2003) for further discussion.

new capital.[8] Another implication is that such firms face a lower cost of capital than firms forced to issue new shares, meaning that investment demand may be stronger when internal funds are available. This provides one potential rationale for the empirical evidence finding that cash flow has a positive impact on investment, holding tax incentives and financial costs constant. Other possible explanations are discussed below.

D. Tax Asymmetries

One final complication in integrating the effects of taxes into the user cost of capital is that companies do not face a single tax rate. While the statutory corporate tax rate is 35 percent for virtually all income subject to the regular corporate tax, the tax system has two important elements that cause income not to be subject to the regular corporate tax. First, firms subject to the corporate alternative minimum tax (AMT) face a tax rate of 20 percent, but on a broader tax base with less generous depreciation allowances and other deductions. Second, firms with net operating losses face an effective current tax rate of zero, in that increments to income have no impact on current tax liability. Provisions that allow operating losses to be carried back or forward to offset other years' income mean that current losses have some sheltering value, and hence that increments to income that reduce current losses do face some implicit tax rate; similar logic applies under the corporate AMT. Various estimates have found that these provisions reduce the effective marginal tax rate on corporate income by several percentage points. For example, Graham (1996) found, for 1992 (when the statutory corporate tax rate was 34 percent), that the average effective tax rate on corporate income (weighted by firm value) was 28 percent.

[8] Indeed, a temporary reduction in the tax rate on dividends, like that enacted in 2003, would (if its prospective sunset were credible) raise the user cost of capital while still possibly raising asset values.

The effect on the user cost of capital, though, is more complicated than the effect of a reduction in the effective corporate tax rate, because firms make transitions over time, being subject to the AMT or having net operating losses in some years but not others. The impact on the user cost of capital is similar to that of facing tax rates that change over time and, given that investment incentives tend to be front-loaded, the user cost may actually be higher for firms without current taxable income than for firms that pay taxes and take deductions immediately.[9]

E. Cyclical Interactions

When considering the impact of tax policy on the incentive to invest, it is useful to distinguish the impact of discretionary changes in policy, on the one hand, and built-in or automatic policy effects, on the other. Absent discretionary policy actions, one can distinguish two channels through which changes in cyclical conditions will affect the user cost of capital. One channel relates to tax asymmetries. The likelihood of having net operating losses or being subject to the AMT rises during recessions. As just discussed, this has an ambiguous impact on the user cost of capital, tending most likely to hurt investments with larger up-front deductions.

Also, the tax burden on investment depends on the rate of inflation, with three effects present. First, the gap between current cost and historic cost grows with inflation, eroding the value of historic-cost depreciation allowances and raising the user cost. Second, as nominal capital gains are taxed, inflation induces an additional tax burden on equity holders. Third, the inflation premium is taxable to bond-holders and deductible by corporate borrowers; given the gap between the tax rates on interest paid and interest received, this amounts to a net reduction in the tax burden on investment. Taking these factors together, the literature has generally found that inflation increases the user cost, by as much as 0.5 percentage points for each percentage-

[9] Auerbach (1983) found this to be the case, empirically, for equipment investment in the early 1980s.

point increase in the inflation rate. The strength of this effect, though, depends critically on one's assumption about the nominal interest rate's response to the inflation rate. For a one-for-one response – the classic Fisher effect, which would imply a reduction in the after-tax returns to bondholders with positive marginal tax rates – the impact of inflation on the user cost would not be particularly large and could even be reversed for long-lived assets for which depreciation allowances are not an important part of after-tax cash flow (Cohen, Hassett, and Hubbard 1999).

III. Empirical Evidence

A variety of strategies have been used to estimate the effects of taxation on investment.[10] In time-series analysis using the forward-looking user cost model described above, Auerbach and Hassett (1992) found significant but economically small effects of the user cost on investment in equipment and nonresidential structures. For equipment, the coefficient of the investment-capital ratio on the user cost of capital was around -0.25, which implies an elasticity of about -0.37.[11] The elasticity for structures was even smaller in absolute value. Time-series estimates based on the *Q* theory of investment, from which one can make inferences about the impact of user-cost changes, also found a relatively weak investment response (e.g., Summers 1981).

Aside from the possibility of model misspecification, a potential explanation for these results is that adjustment costs are very high, a hypothesis discussed above. But an alternative explanation is measurement error. As discussed above, it is difficult to know what the equity cost of capital is at a given moment, or how it changes from year to year. It is also difficult to know what firm expectations are regarding tax policy. Similar measurement problems exist for year-to-year changes in tax-adjusted *Q*, the independent variable in *Q*-theory regressions.

[10] For a comprehensive recent survey, see Hassett and Hubbard (2002).

[11] This estimate equals the product of the coefficient, -0.25, multiplied by the mean user cost of capital in the sample, 0.25, divided by the sample average investment-capital ratio for equipment, 0.17.

One strategy developed to deal with this problem involves focusing on years in which major tax reforms occurred, using cross-section differences in tax provisions to identify the effects of user costs and *Q*. Estimates of user cost models for the Tax Reform Act of 1986 (Auerbach and Hassett 1991) and for both user cost and *Q*-theory models for several tax reforms (Cummins, Hassett, and Hubbard 1994) found substantially larger effects than those in the time-series literature. In the latter paper, for example, the mean coefficient of the user cost in equations explaining equipment investment was -0.65 for tax reform years, more than twice the size of the time-series coefficient reported by Auerbach and Hassett (1992). Further evidence of the measurement-error explanation comes from the much smaller effects that Cummins, Hassett and Hubbard report for years without major tax reforms, since in theory the underlying effects should be the same whether tax changes are large or small. It is also possible, though, that the true cross-section and time-series effects may differ. For example, overall capacity constraints may be more relevant for changes in the level of investment than for changes in the mix of investment. Thus, we might observe a larger response when there is a shift in the relative incentives to invest among firms and assets (which is what cross-section analysis picks up) than with respect to changes in investment incentives over time.

Another important empirical issue involves the role that cash flow or some other measure of firm liquidity plays in determining investment. The work of Fazzari, Hubbard and Peterson (1988) found that cash flow was an important determinant of investment even when other factors were controlled for, especially for low-payout firms likely to be cash-constrained. Several subsequent papers have confirmed the empirical relevance of cash flow, while others have questioned its interpretation as an indication of liquidity constraints.

An obvious problem with a variable like cash flow is that it is highly correlated with a firm's success and prospects. Hence, it should be correlated with investment as well. Although structural models based on the user cost or the *Q* theory should, if properly specified, already account for future prospects, misspecification or measurement error could weaken explanatory power of the structural variables and leave room for cash flow to have an effect. A result consistent with this explanation is that of Cummins, Hassett and Oliner (forthcoming), who find that, when using a measure of *Q* based on analysts' forecasts (which they argue may be a less noisy measure than market value of firm prospects), cash flow is no longer a significant determinant of investment when added to the equation.

Thus, there is still uncertainty regarding the interpretation of the impact of cash flow on investment. There are several potential reasons why cash flow might actually affect investment, including not only the liquidity constraints emphasized in the literature but also the tax benefits of retained earnings already discussed as well as traditional theories of managerial behavior. If cash flow really does have an impact on investment, then the discussion above about the impact of taxation is incomplete – one must consider not only how taxes affect the user cost, but also how they affect cash flow. For example, (1) front-loaded investment incentives might be especially valuable for spurring investment; (2) reductions in the taxation of existing assets, though having no impact on the user cost of capital, might still encourage investment; and (3) policies that reduce the user cost through provisions at the shareholder level may be less effective than policies that do so at the corporate level.

IV. Conclusions

For a number of reasons, the theory of how taxes affect the user cost of capital is subtle and complex. Among the complications discussed above are the distinction between new and

existing assets, shareholder taxation and the treatment of debt and equity, asymmetries in the tax code, and expectations regarding the path of future tax policy. These same factors, as well as many standard econometric problems, have complicated the empirical analysis of investment as well. But theoretical developments also have contributed to empirical advances, leaving us more confident than in the past that taxes affect business fixed investment by influencing the cost of using capital in production. Many questions remain unresolved, of course, for example the strength of the separate impact of liquidity on investment and the extent to which responses to taxation are weaker when there is excess capacity. Finally, while recent evidence may strengthen our belief in the effects of tax policy on investment, it does not necessarily imply that these effects can be beneficially harnessed in the pursuit of short-term stabilization policy.

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